

FIG 1

add constraint

budget
min/max qty
precedence
linear

item	bid value	status
1	93	SELECTED
2	43	UNSELECTED
3	21	SELECTED
4	17	UNSELECTED
5	29	UNSELECTED

basic bid data

edit constraint

Set	budget
1, 2,3	120
3,4,5	50

budget constraints

add bid

item	precedence set
3	1
3	2,4

recedence constraints

min qty	set	max qty
2	1,2,3,4	
	2,4,5	2

quantity constraints

item	coef	coef
1	10	10
2	10	-10
3	20	10
4	40	-10
5		10
total	60	20

linear constraints

FIG 2a

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add constraint

budget
min/max qty
precedence
linear

edit constraint

add bid

item	bid value	status
3	43	UNSELECTED
4	29	SELECTED
5	31	SELECTED
6	12	SELECTED
7	17	UNSELECTED

basic bid data

Set	budget
5,6,7	50

budget constraints

item	coef	coef
3	20	15
4	30	18
5	21	13
6		17
7	30	14
total	50	48

linear constraints

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FIG 2b

Fig. 3a (numeral 34)

$$\text{Max } 93x_{1,1} + 43x_{1,2} + 21x_{1,3} + 17x_{1,4} + 29x_{1,5} + 43x_{2,3} + 29x_{2,4} + 31x_{2,5} + 12x_{2,6} + 17x_{2,7}$$

$$\text{Subject to } x_{3,1} + x_{3,2} \leq 1$$

$$x_{4,1} + x_{4,2} \leq 1$$

$$x_{5,1} + x_{5,2} \leq 1$$

$$93x_{1,1} + 43x_{1,2} + 21x_{1,3} \leq 120$$

$$21x_{1,3} + 17x_{1,4} + 29x_{1,5} \leq 50$$

$$x_{1,2} + x_{1,4} + x_{1,5} \leq 2$$

$$2z_{1,1}^{Min} \leq x_{1,1} + x_{1,2} + x_{1,3} + x_{1,4}$$

$$x_{1,1} \leq z_{1,1}^{Min}$$

$$x_{1,2} \leq z_{1,1}^{Min}$$

$$x_{1,3} \leq z_{1,1}^{Min}$$

$$x_{1,3} \leq z_{1,3,1}^P + z_{1,3,2}^P$$

$$z_{1,3,1}^P \leq x_{1,1}$$

$$2z_{1,3,2}^P \leq x_{1,2} + x_{1,4}$$

$$10x_{1,1} + 10x_{1,2} + 20x_{1,3} + 40x_{1,4} \leq 60$$

$$10x_{1,1} - 10x_{1,2} + 10x_{1,3} - 10x_{1,4} + 10x_{1,5} \leq 20$$

$$31x_{2,5} + 12x_{2,6} + 17x_{2,7} \leq 50$$

$$20x_{2,3} + 30x_{2,4} + 21x_{2,5} + 30x_{2,7} \leq 50$$

$$15x_{2,3} + 18x_{2,4} + 13x_{2,5} + 17x_{2,6} + 14x_{2,7} \leq 48$$

$$x_{1,1}, x_{1,2}, x_{1,3}, x_{1,4}, x_{1,5} \in \{0, 1\}$$

$$x_{2,3}, x_{2,4}, x_{2,5}, x_{2,6}, x_{2,7} \in \{0, 1\}$$

$$z_{1,1}^{Min}, z_{1,3,1}^P, z_{1,3,2}^P \in \{0, 1\}$$

Fig. 3b (numeral 36)

$$\text{Max } 29y_{1,1} + 114y_{1,2} + 60y_{1,4} + 72y_{1,5} + 46y_{1,6} + 153y_{1,7} + 165y_{1,8} + 139y_{1,9} + \\ 43y_{2,1} + 29y_{2,2} + 31y_{2,3} + 12y_{2,4} + 17y_{2,5} + 55y_{2,8} + 60y_{2,9} + 60y_{2,10} + 41y_{2,11} + 104y_{2,14} + 72y_{2,15}$$

Subject to $y_{1,1} + y_{1,2} + y_{1,4} + y_{1,5} + y_{1,6} + y_{1,7} + y_{1,8} + y_{1,9} \leq 1$

$$y_{2,1} + y_{2,2} + y_{2,3} + y_{2,4} + y_{2,5} + y_{2,8} + y_{2,9} + y_{2,10} + y_{2,11} + y_{2,14} + y_{2,15} \leq 1$$

$$y_{1,2} + y_{2,1} + y_{2,8} + y_{2,9} + y_{2,14} + y_{2,15} \leq 1h$$

$$y_{2,4} + y_{1,6} + y_{1,7} + y_{1,9} + y_{2,2} + y_{2,10} + y_{2,11} + y_{2,14} \leq 1$$

$$y_{1,1} + y_{1,5} + y_{1,6} + y_{1,8} + y_{1,9} + y_{2,3} + y_{2,10} + y_{2,14} \leq 1$$

$$y_{1,1}, y_{1,2}, y_{1,4}, y_{1,5}, y_{1,6}, y_{1,7}, y_{1,8}, y_{1,9}, y_{2,1} \in \{0, 1\}$$

$$y_{2,2}, y_{2,3}, y_{2,4}, y_{2,5}, y_{2,8}, y_{2,9}, y_{2,10}, y_{2,11}, y_{2,14}, y_{2,15} \in \{0, 1\}$$

The first constraint selects at most one proposal from player 1;

The second constraint selects at most one proposal from player 2;

The third constraint selects at most one proposal that includes item 3;

The fourth constraint selects at most one proposal that includes item 4;

The fifth constraint selects at most one proposal that includes item 5;

Constraints for items 1,2,6, and 7 are not required in this example, because only one player bids on each of these items and so the item constraint is implied by the player constraint.

Bid data
Including player constraints

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Specify decision variables

0-1 variable for each palyer,item combination that has a bid

Specify constraints and 0-1 auxiliary variables

budget constraints

min and max quantity constraints

precedence constraints

general linear constraints

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Integer programSolver

Driver program that calls commercial software such as OSL

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Solution Processor

Coverts Integer programming solution in to list of selected bids

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Table update processr

idf a bid is selected, set selected_flag = YES.

Otherwise set selecte_flag = NO

BLOCK 20

FIG 4

Bid data Including player constraints

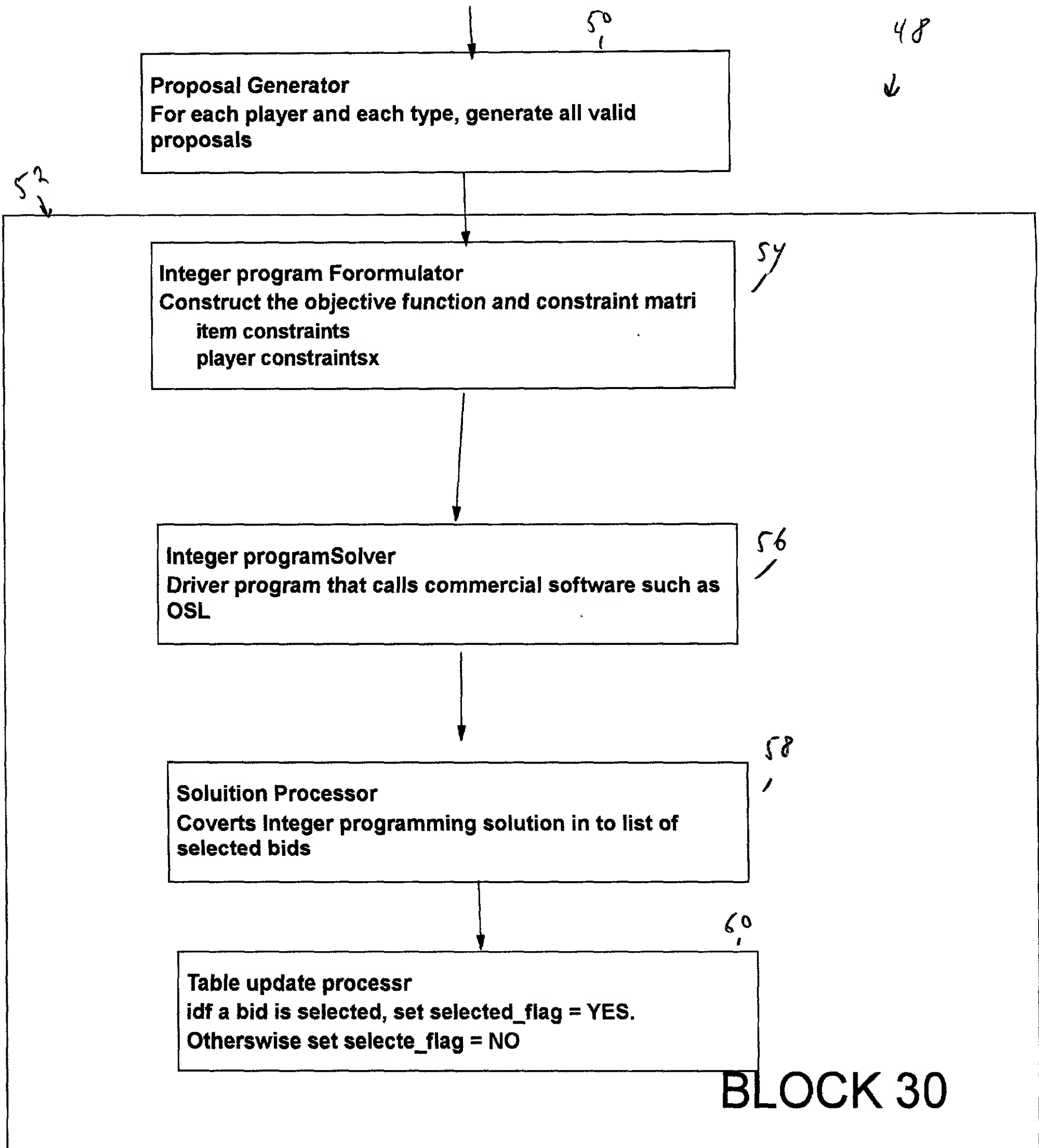


FIG 5

proposal	Items	Value	Reject ?
1	5	29	
2	1,3	114	
3	1,5	122	YES
4	2,4	60	
5	2,5	72	
6	4,5	46	
7	1,2,4	153	
8	1,2,5	165	
9	1,4,5	139	
10	1,2,3,5	182	YES

player 1's proposals

proposal	Items	Value	Reject ?
1	3	43	
2	4	29	
3	5	31	
4	6	12	
5	7	17	
6	3,4	72	YES
7	3,5	74	YES
8	3,6	55	
9	3,7	60	
10	4,5	60	
11	4,6	41	
12	5,6	43	YES
13	6,7	29	YES
14	3,4,5	104	
15	3,6,7	72	

player 2's proposals

FIG 6

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